

CLAIMS

What I claim is:

1. An isolated mammalian nucleic acid molecule encoding a receptor protein tyrosine kinase expressed in primitive hematopoietic cells and not expressed in mature hematopoietic cells.
2. A nucleic acid molecule according to claim 1 wherein the nucleic acid molecule is DNA.
3. A nucleic acid molecule according to claim 2 wherein the nucleic acid molecule is cDNA.
4. A nucleic acid molecule according to claim 1 wherein the nucleic acid molecule is RNA.
5. A nucleic acid molecule according to claim 1 that is a mouse nucleic acid molecule.
6. A nucleic acid molecule according to claim 5 that is flk-2 comprising the sequence shown in Figure 1a and SEQ. ID. NO. 1.
7. A nucleic acid molecule according to claim 1 that is a human nucleic acid molecule.
8. A nucleic acid molecule according to claim 7 that is DNA.
9. A nucleic acid molecule according to claim 7 that is flk-2 comprising the sequence shown in Figure 1b and SEQ. ID. NO. 3.
10. An isolated acid nucleic molecule that is flk-2 comprising the sequence shown in Figure 1a and SEQ. ID. NO. 1.

11. A nucleic acid molecule according to claim 10 wherein the nucleic acid molecule is DNA.
12. An isolated nucleic acid molecule that is flk-2 comprising the sequence shown in Figure 1b and SEQ. ID. NO. 3.
13. A nucleic acid molecule according to claim 12 wherein the nucleic acid molecule is DNA.
14. An isolated nucleic molecule that is flk-1 having the sequence shown in Figure 2 and SEQ. ID. NO. 5
15. A nucleic acid molecule according to claim 14 wherein the nucleic acid molecule is DNA.
16. A nucleic acid molecule according to claim 14 wherein the nucleic acid molecule is cDNA.
17. A nucleic acid molecule according to claim 14 that has the corresponding sequence of RNA.
18. A vector comprising a mammalian nucleic acid molecule encoding a receptor protein tyrosine kinase expressed in primitive hematopoietic cells and not expressed in mature hematopoietic cells.
19. A vector comprising flk-1 having the nucleic acid sequence of Figure 2 and SEQ. ID. NO. 5
20. A vector comprising flk-2 having the nucleic acid sequence of Figure 1a and SEQ. ID. NO. 1 or Figure 1b and SEQ. ID. NO. 3.
21. A vector according to claim 18 wherein the vector is capable of being cloned in a host.

22. A vector according to claim 19 wherein the vector is capable of being cloned in a host.
23. A vector according to claim 20 wherein the vector is capable of being cloned in a host.
24. A vector according to claim 21 wherein the host is a prokaryotic host.
25. A vector according to claim 22 wherein the host is a prokaryotic host.
26. A vector according to claim 23 wherein the host is a prokaryotic host.
27. A vector according to claim 18 that is capable of expressing the nucleic acid molecule in a host.
28. A vector according to claim 19 that is capable of expressing flk-1 in a host.
29. A vector according to claim 20 that is capable of expressing flk-2 in a host.
30. A vector according to claim 27 wherein the host is a prokaryotic host.
31. A vector according to claim 28 wherein the host is a prokaryotic host.
32. A vector according to claim 29 wherein the host is a prokaryotic host.
33. A vector according to claim 27 wherein the host is a eucaryotic host.

34. A vector according to claim 28 wherein the host is a eucaryotic host.
35. A vector according to claim 29 wherein the host is a eucaryotic host.
36. An isolated protein tyrosine kinase expressed in primitive hematopoietic cells and not expressed in mature hematopoietic cells.
37. The protein tyrosine kinase according to claim 36 that is flk-2 having the sequence shown in Figure 1a and SEQ. ID. NO. 1 or Figure 1b and SEQ. ID. NO. 3.
38. The protein tyrosine kinase according to claim 36 that is human flk-2.
39. The protein tyrosine kinase according to claim 38 that is flk-2 having the sequence shown in Figure 1b and SEQ. ID. NO. 3.
40. An isolated protein tyrosine kinase that is flk-1 having the sequence shown in Figure 2 and SEQ. ID. NO. 5.
41. A ligand that binds to a receptor protein tyrosine kinase expressed in primitive mammalian hematopoietic cells and not expressed in mature hematopoietic cells, wherein the ligand stimulates the proliferation and/or differentiation of the primitive hematopoietic cells.
42. A ligand that binds to the receptor protein tyrosine kinase having the amino acid sequence of flk-1 shown in Figure 2 and SEQ. ID. NO. 5, wherein the ligand stimulates the proliferation and/or differentiation of cells that express flk-1.

43. A ligand that binds to the receptor protein tyrosine kinase having the amino acid sequence of flk-2 shown in Figure 1a and SEQ. ID. NO. 1 or Figure 1b and SEQ. ID. NO. 3, wherein the ligand stimulates the proliferation and/or differentiation of cells that express flk-2.
44. A nucleic acid molecule encoding a ligand that binds to a receptor protein tyrosine kinase expressed in primitive mammalian hematopoietic cells and not expressed in mature hematopoietic cells, wherein the ligand stimulates the proliferation and/or differentiation of the primitive hematopoietic cells.
45. A nucleic acid molecule encoding a ligand that binds to the receptor protein tyrosine kinase having the amino acid sequence of flk-1 shown in Figure 2 and SEQ. ID. NO. 5, wherein the ligand stimulates the proliferation and/or differentiation of cells that express flk-1.
46. A nucleic acid molecule encoding a ligand that binds to the receptor protein tyrosine kinase having the amino acid sequence of flk-2 shown in Figure 1a and SEQ. ID. NO. 1 or Figure 1b and SEQ. ID. NO. 3, wherein the ligand stimulates the proliferation and/or differentiation of cells that express flk-2.
47. A nucleic acid molecule according to claim 44 wherein the nucleic acid molecule is DNA. ✓
48. A nucleic acid molecule according to claim 44 wherein the nucleic acid molecule is cDNA. ✓
49. A nucleic acid molecule according to claim 44 wherein the nucleic acid molecule is RNA. ✓

50. A nucleic acid molecule according to claim 45 wherein the nucleic acid molecule is DNA.
51. A nucleic acid molecule according to claim 45 wherein the nucleic acid molecule is cDNA.
52. A nucleic acid molecule according to claim 45 wherein the nucleic acid molecule is RNA.
53. A nucleic acid molecule according to claim 46 wherein the nucleic acid molecule is DNA.
54. A nucleic acid molecule according to claim 46 wherein the nucleic acid molecule is cDNA.
55. A nucleic acid molecule according to claim 46 wherein the nucleic acid molecule is RNA.
56. A method of stimulating the proliferation and/or differentiation of primitive mammalian hematopoietic stem cells comprising contacting the stem cells with a ligand that binds to a receptor protein tyrosine kinase expressed in primitive mammalian hematopoietic cells and not expressed in mature hematopoietic cells.
57. A method of stimulating the proliferation and/or differentiation of primitive mammalian hematopoietic stem cells comprising contacting the stem cells with a ligand that binds to the receptor protein tyrosine kinase having the nucleic acid sequence of flk-1 shown in Figure 2 and SEQ. ID. NO. 5.
58. A method of stimulating the proliferation and/or differentiation of primitive mammalian hematopoietic stem cells comprising contacting the stem cells with a ligand

that binds to the receptor protein tyrosine kinase having the nucleic acid sequence of flk-2 shown in Figure 1a and SEQ. ID. NO. 1 or Figure 1b and SEQ. ID. NO. 3.

59. A method according to claim 56 wherein the stimulation occurs in vitro.
60. A method according to claim 57 wherein the stimulation occurs in vitro.
61. A method according to claim 58 wherein the stimulation occurs in vitro.
62. A method according to claim 56 wherein the stimulation occurs in vivo.
63. A method according to claim 57 wherein the stimulation occurs in vivo.
64. A method according to claim 58 wherein the stimulation occurs in vivo.
65. Murine cell line 2018 having ATCC accession number ATCC CRL 10907.
66. A recombinant nucleic acid molecule that is murine flk-2 having the sequence shown in Figure 1a and SEQ. ID. NO. 1.
67. A recombinant nucleic acid molecule comprising the sequence shown in Figure 1a and SEQ. ID. NO. 1 from nucleotide 1 to nucleotide 1662.
68. A recombinant nucleic acid molecule comprising the sequence shown in Figure 1a and SEQ. ID. NO. 1 from nucleotide 31 to nucleotide 3006.

69. A recombinant nucleic acid molecule comprising the sequence shown in Figure 1a and SEQ. ID. NO. 1 from nucleotide 112 to nucleotide 3006.
70. An isolated mRNA that encodes the murine flk-2 protein, said protein having the amino acid sequence shown in Figure 1a and SEQ. ID. NO. 1.
71. A recombinant nucleic acid molecule that is human flk-2 having the sequence shown in Figure 1b and SEQ. ID. NO. 3.
72. A recombinant nucleic acid molecule comprising the sequence shown in Figure 1b and SEQ. ID. NO. 3 from nucleotide 1 to nucleotide 1689.
73. A recombinant nucleic acid molecule comprising the sequence shown in Figure 1b and SEQ. ID. NO. 3 from nucleotide 58 to nucleotide 3036.
74. A recombinant nucleic acid molecule comprising the sequence shown in Figure 1b and SEQ. ID. NO. 3 from nucleotide 139 to nucleotide 3036.
75. An isolated mRNA that encodes the human flk-2 protein, said protein having the amino acid sequence shown in Figure 1b and SEQ. ID. NO. 3.
76. A recombinant nucleic acid molecule that is murine flk-1 having the sequence shown in Figure 2 and SEQ. ID. NO. 5.
77. A recombinant nucleic acid molecule comprising the sequence shown in Figure 2 and SEQ. ID. NO. 5 from nucleotide 1 to nucleotide 2493.
78. A recombinant nucleic acid molecule comprising the sequence

shown in Figure 2 and SEQ. ID. NO. 5 from nucleotide 208 to nucleotide 4308.

79. A recombinant nucleic acid molecule comprising the sequence shown in Figure 2 and SEQ. ID. NO. 5 from nucleotide 265 to nucleotide 4308.

80. An isolated mRNA that encodes the murine flk-1 protein, said protein having the amino acid sequence shown in Figure 2 and SEQ. ID. NO. 5.

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